

AD-A047 431

DEFENCE RESEARCH ESTABLISHMENT OTTAWA (ONTARIO)  
THE DREO FABRIC WEAR AND DESIGN COURSE. (U)  
OCT 77 R W NOLAN, A DALPE

F/G 15/5

UNCLASSIFIED

DREO-TN-77-18

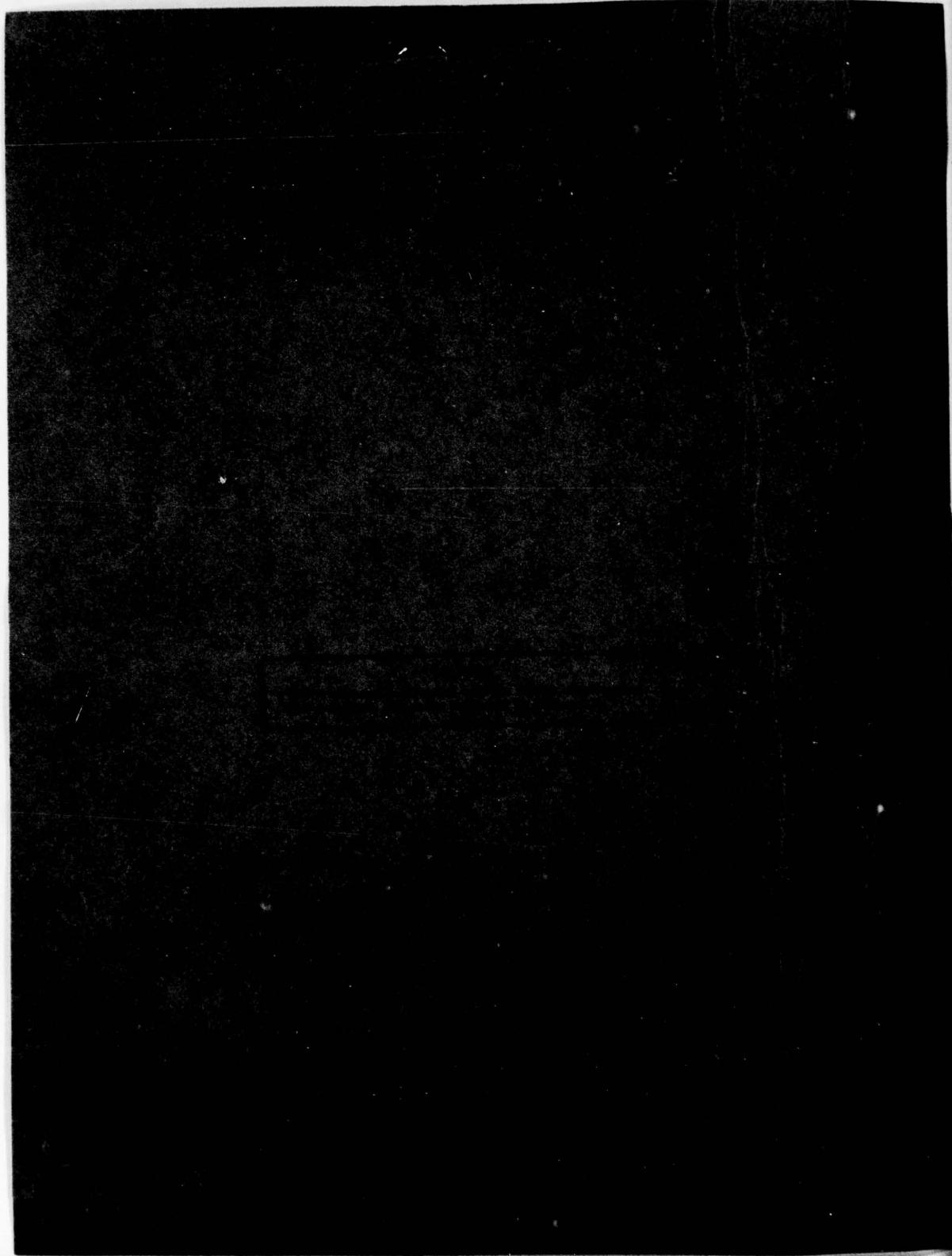
NL

1 OF 1  
AD  
A047431



END  
DATE  
FILMED  
I- 78  
DDC

ADA047431



RESEARCH AND DEVELOPMENT BRANCH

DEPARTMENT OF NATIONAL DEFENCE  
CANADA

⑨ Technical note,

DEFENCE RESEARCH ESTABLISHMENT OTTAWA

TECHNICAL NOTE NO. 77-18

⑭ DRE 6-TN-77-18

⑪ Oct 77

⑫ 50¢ p.

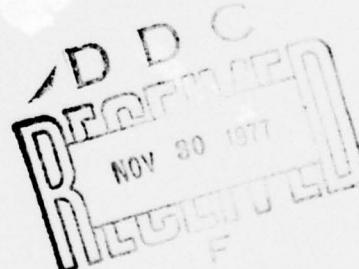
⑥ THE DREO FABRIC WEAR AND DESIGN COURSE.

by

⑩ R.W. Nolan ■ A. Dalpé

Physiological Evaluation Group  
NBC Defence Division

404 576



PROJECT NO.  
79-03-05

77-160

RECEIVED SEPTEMBER 1977  
PUBLISHED OCTOBER 1977  
OTTAWA

DISTRIBUTION STATEMENT A

Approved for public release;  
Distribution Unlimited

fluv

UNCLASSIFIED

ABSTRACT

A brief general description of the DREO field facility for evaluating clothing together with a number of photographs which describe the component sections of the testing course in detail is given. Its purpose is to acquaint those who may have a requirement for testing of this nature with the existence and characteristics of the course.

RÉSUMÉ

Brève description d'ensemble des services d'évaluation des vêtements par DREO, accompagnée de photographies illustrant de façon détaillée les divers éléments du cours. Le but est de porter l'existence de ce cours à la connaissance de tous ceux qui pourraient avoir besoin d'essais de ce genre, et de leur en indiquer les caractéristiques.

UNCLASSIFIED  
(1)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------

INTRODUCTION

One of the more important stages in the design and development of military clothing and personal equipment is the scientific evaluation of prototype garments when worn by potential users under realistic field conditions. Military clothing and equipment usually must be designed to withstand greater strain than similar civilian items and if failures do occur in a military situation, the consequences may be serious. Testing to ensure reliability is important. Thus, before a new item of clothing is introduced into the Canadian Forces, small numbers of the proposed item are subjected to extensive testing to determine whether or not the item meets all requirements.

Clothing evaluations are usually conducted by having a small number of test subjects wearing the garments of interest perform standardized activities in order to assess design features such as proper sizing to permit freedom of movement, ease of donning and doffing and comfort afforded. Other aspects which might be investigated include durability of seams under stress or location of pockets and closures regarding ease of access, etc. Especially in military clothing, such features are as important as the proper selection of the materials used in the clothing. Standardized realistic test conditions usually take the form of a series of obstacles over which test subjects run, jump and crawl a number of times in order to stress the clothing which they are wearing. Evaluations of this nature may also be used to provide accelerated wearing of the materials themselves under realistic conditions.

Since it is difficult to obtain absolute measurements, the testing of prototype clothing is usually done comparatively, using clothing with known characteristics as well as the test clothing. The evaluation of prototype clothing using the field facility described in this paper includes objective measurements as well as subjective measurements. Usually both the wearers and the scientific observers comment on performance. Questionnaires, carefully designed to obtain the maximum information from the test subjects are usually used.

GENERAL DESCRIPTION OF TESTING FACILITY

The DREO Fabric Wear and Design Course is a field facility situated in a remote location about five miles from the main Shirley Bay laboratory.

## UNCLASSIFIED

It comprises two distinct testing courses (the Fabric Wear Course and the Design Course) each of which consists of a selection of different obstacles designed to simulate various physical situations which may be encountered by soldiers during military field activity. Soldiers wearing specific items of clothing and equipment move over or through selected sets of obstacles a number of times subjecting the test items to different types of abrasion and stress which may cause wear or failure of the items. Such tests normally will reveal in a relatively short period of time super-iorities or deficiencies which may exist in the test items.

The Fabric Wear Course is designed to provide controlled accelerated wearing of the various fabrics and materials used in items of military clothing. Test subjects wearing the clothing of interest crawl, slide and climb over a series of 29 obstacles which have been constructed using materials such as wood, concrete, sand and gravel to test the durability of the materials used in the clothing. Each of the obstacles is described in detail later. Trousers probably receive the greatest wear of any of the garments subjected to this course so the most effective means of evaluating a test fabric in this manner is to manufacture trousers using the test material. Wear is measured by inspecting the test clothing after it has been subjected to the course a number of times and recording the size, number and location of tears, frays and holes together with possible reasons for failure.

The Design Course consists of a series of 10 obstacles (described below) constructed to provide a means of stressing items of clothing to evaluate design features such as seam strength or restrictions on freedom of movement imposed on test subjects wearing the clothing while performing specified manoeuvres. In contrast to the abrasion and wearing of fabrics caused by the obstacles of the Fabric Wear Course, the obstacles of the Design Course are used primarily to cause the test subjects to stretch and extend their arms and legs in various directions, imposing strain on the seams of the test clothing. In addition, the test subjects themselves are stressed so that any unnecessary encumbrances or restrictions caused by the clothing or equipment being evaluated are quickly manifested. Again, clothing degradation is measured by inspecting the test items after being worn on the course a number of times and recording size, number and location of and possible reasons for any failures observed.

Obviously, in any given trial or evaluation, it is not necessary to utilize all of the obstacles available at either of the testing courses. Obstacles may be selected individually or in combination to assess specific functions of the clothing or equipment being evaluated. Similarly, wear is not the only criterion which may be used to evaluate performance. The length of time required for test subjects to complete the course or portions of it may also be used as a measure of the restrictions imposed on the subjects by experimental clothing and equipment. Usually when time is used, experimental items are tested in comparison with standard or control items and one determines percentage improvement or deterioration caused by the test item.

The DREO course is situated on mainly sandy soil in a clearing surrounded by a heavily wooded area. The type of soil is ideally suited for conducting trials which involve tasks such as jumping or digging trenches. Reference 1 describes a field trial, part of which was conducted at this test site, where subjects shovelled measured quantities of sand in a specified period of time as part of an experiment to evaluate physiological heat stress imposed by protective overgarments. The site can also be used for conducting many of the exercises such as digging, high jumping and long jumping specified in the NATO Triptique for the evaluation of NBC protective clothing (2). Descriptions of other testing techniques and courses similar to the DREO Fabric Wear and Design Course for the testing of clothing and equipment ensembles may be found in references 3-6.

The testing course has been in existence at DREO for a number of years and was recently refurbished. The primary purpose of this technical note is to make the facility known to those who may have a requirement for testing of this nature but who previously may have been unaware of its existence.

The remainder of this paper consists of a number of photographs showing the various obstacles in the testing courses. The wooden stick carried by the test subjects in the photographs is used to simulate carrying a rifle. Where necessary, individual obstacles are described in detail in the captions. Figures 1 to 29 illustrate the obstacles which make up the Fabric Wear Course and Figures 30 - 39 illustrate those of the Design Course. Figure 40 is a diagram of the overall site plan.

UNCLASSIFIED

REFERENCES

1. Custance, A.C., H.L. Nash and S.W. Cattroll, "Preliminary Field and Hot Chamber Trials of Candidate CW Overgarments of Canadian Design", DREO Report No. 547, March 1968.
2. "Combined Operational Characteristics, Technical Specifications and Evaluation Criteria (Triptych) for NBC Protective Clothing", NATO Document AC/225 (Panel VII) D/101, Section 3, Oct. 1971.
3. Wynne, R.W., "The Building Calibration and Use of A Clothing and Equipment Field Facility", Army Personnel Research Establishment (UK), paper presented at the 11th Commonwealth Conference on Defence Operational Clothing and Combat Equipment, 1975.
4. Eastcott, J., A.C. Jones and J.W. Mayne, "Manual of Field Testing", Fourth Commonwealth Defence Conference, 1953.
5. "The Accelerated Wear Program", U.S. Army Quartermaster Research & Engineering Field Evaluation Agency, Fort Lee, Virginia, 1959.
6. Nolan, R.W., "Testing of Materials and Evaluation of Clothing Systems", in "A Bibliography On Arctic Clothing", edited by L.G. Wilson, DREO Technical Note No. 75-18, Oct. 1975. (Restricted).

UNCLASSIFIED



Fig. 1 - Sand Cover, 6 x 3 m. Subject traverses the length of the obstacles, crawling on stomach (Leopard Crawl).



*Fig. 2 - Sand Cover, 11 x 3 m. Subjects crawl on hands and knees.*

UNCLASSIFIED

7



*Fig. 3 - Sand Cover, 9 x 3 m. Subjects execute leopard crawl.*

UNCLASSIFIED

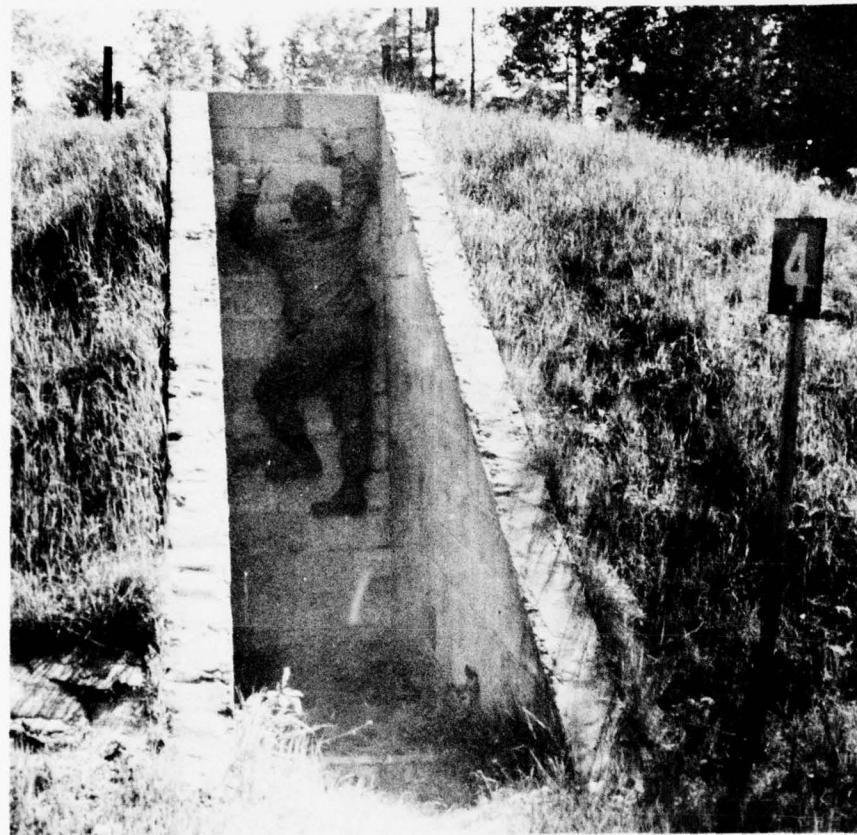


Fig. 4 - Vertical Wall, 0.9 m wide x 3 m high, made of 21-cm-high concrete blocks set in 4-cm steps. Subject climbs wall to top of small hill, rubbing clothing on concrete.



Fig. 5 - Railway Ties, 1.5 x 1.7 m. Subject crawls over rails under barbed wire suspended 0.4 m above ground.



Fig 6 - Stone Ramp, smooth stones approx. 18 cm. diameter embedded in concrete 3.3 x 2.4 m. Subject slides headfirst down 60° ramp on stomach.



*Fig. 7 - Sand Cover, 6 x 3 m. Subject traverses the length of the obstacle crawling on back.*



Fig. 8 - Hurdle, smooth concrete wall 1.5 x 0.2 x 0.5 m. high.  
Subject crawls over, rubbing clothing.

UNCLASSIFIED

13



*Fig. 9 - Sand Cover, 10 x 50. Subjects traverse crawling on hands and knees.*

UNCLASSIFIED



*Fig. 10 - Sand Cover, 9.5 x 1.5 m. Subjects traverse crawling on back.*

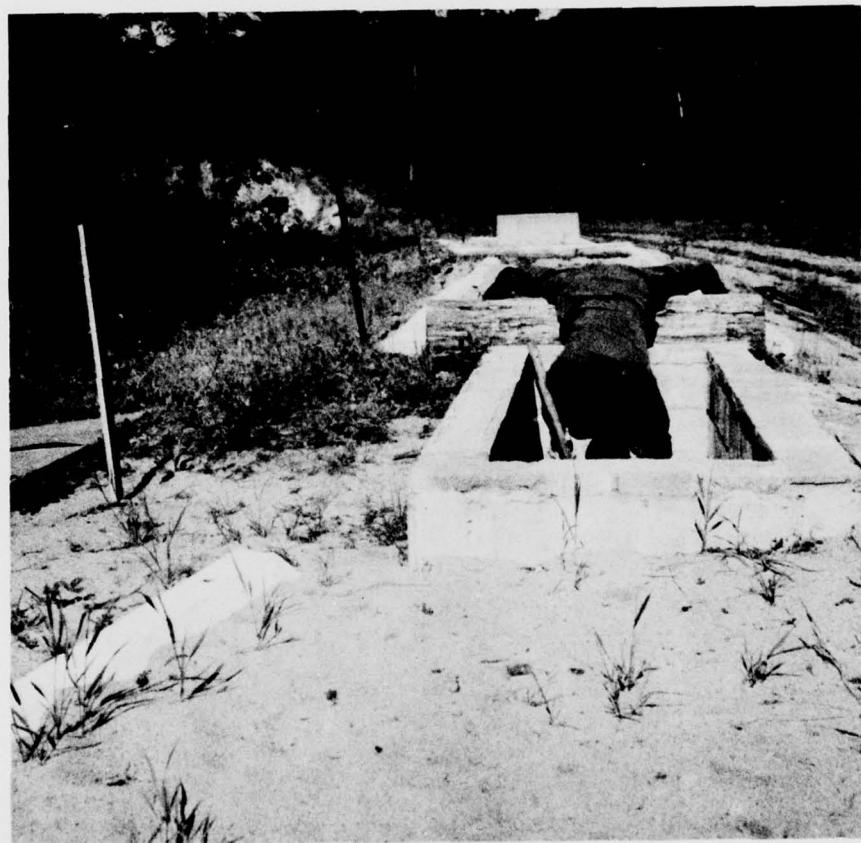


Fig. 11 - Concrete Block Pit, concrete block walls with earth floor,  $2.4 \times 0.8 \times 0.9$  m deep. Subjects crawl in and out.

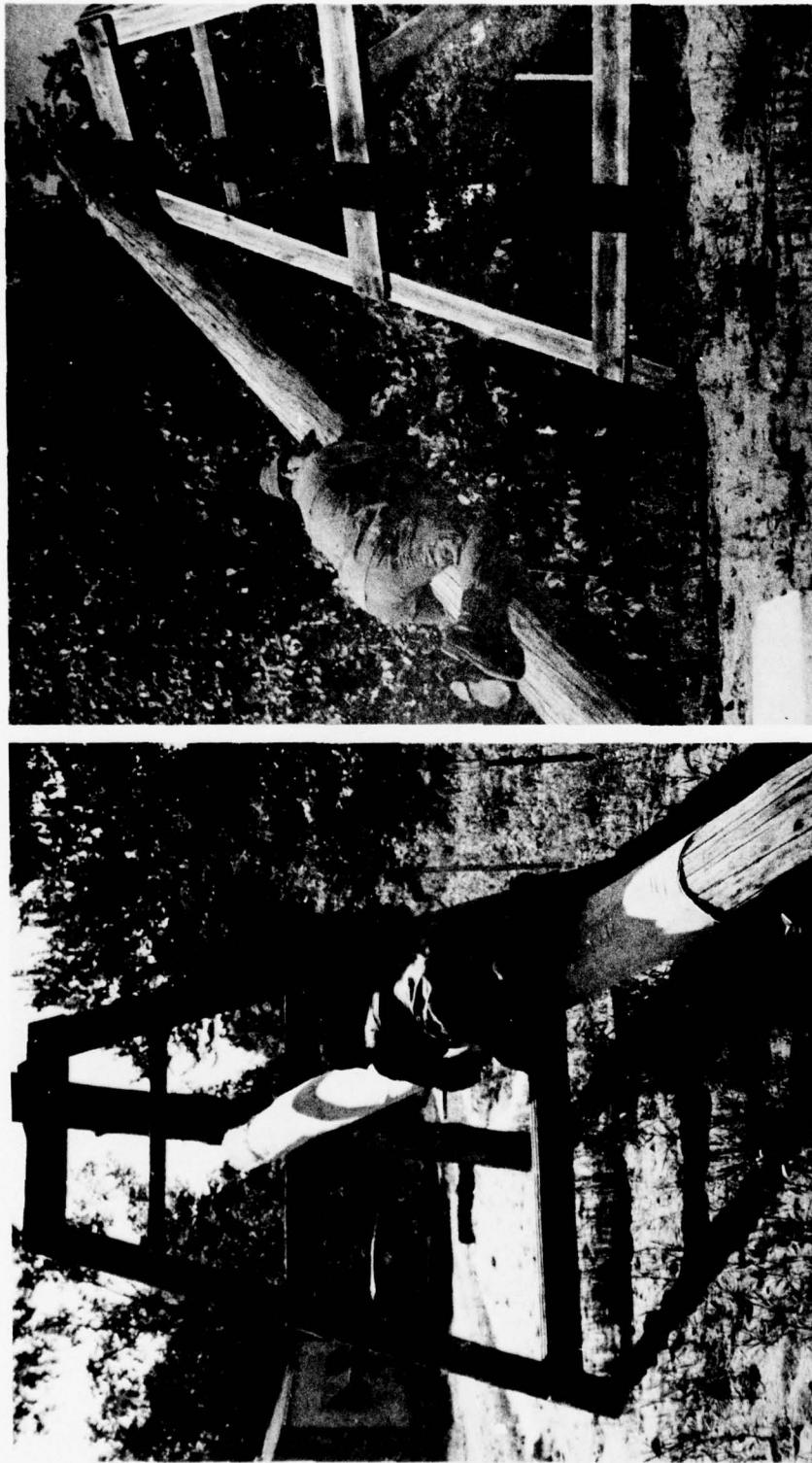


Fig. 12 - Inclined Log Bridge, two 10-cm-diameter logs approx. 4.5 in length, inclined at  $35^{\circ}$  and  $50^{\circ}$ . Subjects climb up approach which is covered with canvas and slide backwards down second log (uncovered).  
(a) approach  
(b) descent

UNCLASSIFIED



*Fig. 13 - Sand Cover, 7 x 1.5 m. Subjects traverse using leopard crawl.*

UNCLASSIFIED



Fig. 14 - Gravel Cover, 11 x 1.5 m, 3-cm-dia. gravel. Subjects traverse using leopard crawl.

UNCLASSIFIED

19



*Fig 15 - Sand Cover, 27 x 2 m. Subjects crawl on hands and knees.*

UNCLASSIFIED



Fig 16 - Log Hurdle. Subjects crawl over hurdle 1.2 m high made of split logs 15-cm dia. x 2 m long.



*Fig. 17 - Sand Cover, 5 x 1.6 m. Subjects traverse using leopard crawl.*



Fig. 18 - Sand Cover, 9 x 1.5 m. Subjects crawl on hands and knees.  
(Obstacle 19 is similar to Obstacle 18).



Fig. 20 - Pill Box,  $1.7 \times 1.1 \times 0.6$  m high, covered in smooth 10-cm-dia. stones set in concrete. Subjects crawl over on stomach.



Fig. 21 - Sand Cover, 7 x 1.2 m. Subjects traverse using leopard crawl.



Fig. 22 - Concrete Block Pit, concrete block walls with earth floor,  
1.8 x 0.8 x 0.7 m deep. Subjects crawl in and out.

UNCLASSIFIED



Fig. 23 - Pipe Crawl. Subjects crawl through concrete pipe 0.6 m dia., 5 m long.

UNCLASSIFIED



Fig. 24 - Sand Cover, 11 x 2 m. Subjects traverse crawling on back.

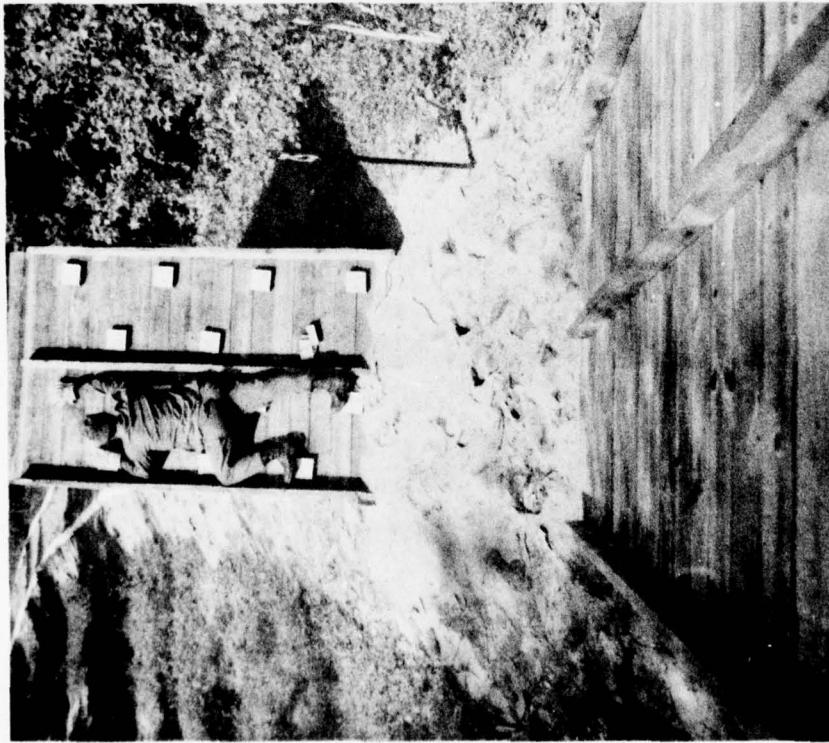


Fig. 25 - Wooden Ramps. Two ramps separated by 2 m of sand cover with faces of dressed lumber  $2.4 \times 1.7$  and  $3.7 \times 1.7$  m and inclined at  $45^\circ$  and  $75^\circ$  respectively. Subjects crawl up first face which has 14-cm-square wooden blocks to assist climbing and slide down second face head first.



Fig. 26 - Sand Cover, 52 x 2 m. Subjects crawl on hands and knees.



Fig. 27 - Sand Cover, 6 x 2.2 m. Subjects crawl on back under barbed wire suspended 45 cm above ground.

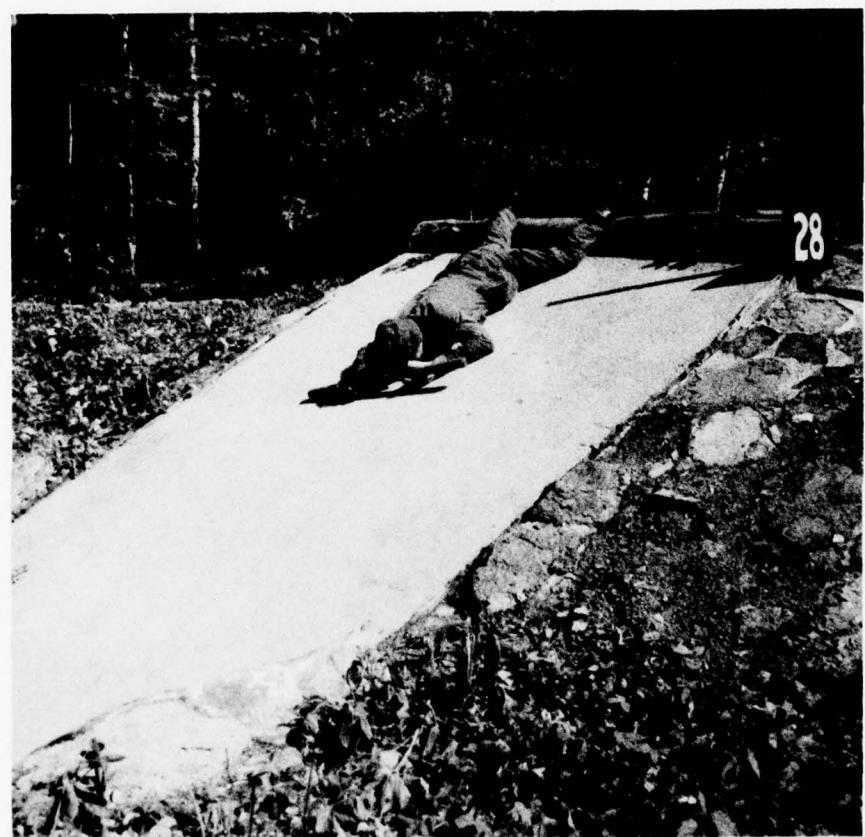


Fig. 28 - Concrete Ramp, smooth concrete  $3.6 \times 2.6$  m inclined at  $45^\circ$ . Subjects slide down on stomach head first.



Fig. 29 - Vertical Wall. Seven courses of concrete blocks set in 4-cm steps forming a wall  $2.9 \times 1.5$  m high. Subjects climb up, rubbing clothing.

UNCLASSIFIED



Fig. 30 - Low Hurdle - a series of five wooden hurdles, 0.8 m high, spaced 4.5 m apart. Subjects step over each in turn stretching and stressing seam in crotch of trousers.

UNCLASSIFIED



Fig. 31 - Straddle Run - 12 automobile tires placed in a zig-zag pattern with centers approx. 1.5 m apart. Subjects run through obstacles placing feet alternately in centre of tires.

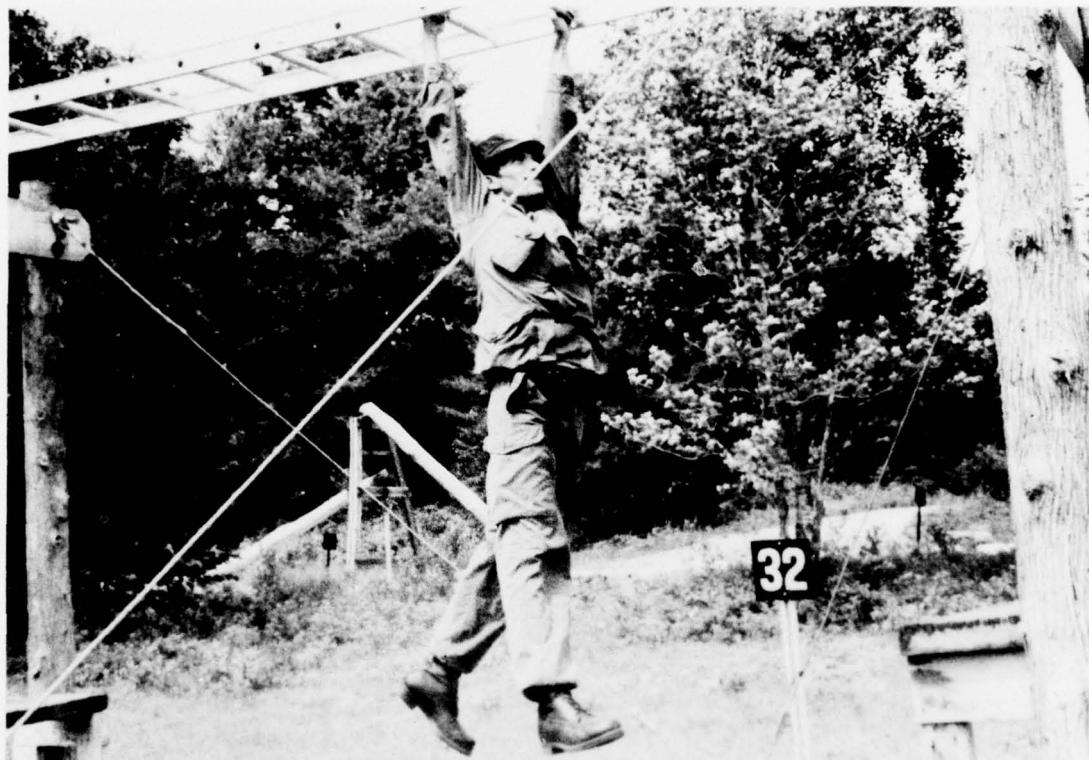


Fig. 32 - Overhead Ladder - ladder 4.6 m long, suspended 2.8 m above the ground with rungs 30 cm apart. Subjects mount wooden platform 1 m above ground at end and traverse the ladder swinging from hand to hand. Tests armpit & shoulder seams.



Fig. 33 - Concrete Block Wall  $2.5 \times 1.7 \times 0.3$  m. Subjects climb over, stretching seams and rubbing clothing.



Fig. 34 - Rope Swing - 5 cm dia. x 9 m long manilla rope suspended from a support 7.6 m above ground. Subjects swing across a sand pit 3.4 x 2 x 1.4 m deep.



Fig. 35 - Scramble Net, 1.8 x 3.4 m high, made of 1.6-cm-diameter polyester rope in an 18-cm-square mesh. Subjects climb up one side and down the other.



*Fig. 36 - High Hurdle, 2.6 x 2.6 m, made of 15-cm-diameter logs. Two logs are positioned horizontally 1.4 m and 2.6 m above ground level. Subjects climb over.*



Fig. 37 - Pipe Ladder. Metal pipes arranged to form a stepladder with sides 3.7 m. Rungs are 0.8 m apart. Subjects climb over.



Fig. 38 - High Step Grid. Wooden grid  $3.6 \times 2.4$  m, 0.6 m above ground. Subjects step in alternate 0.6 m squares.

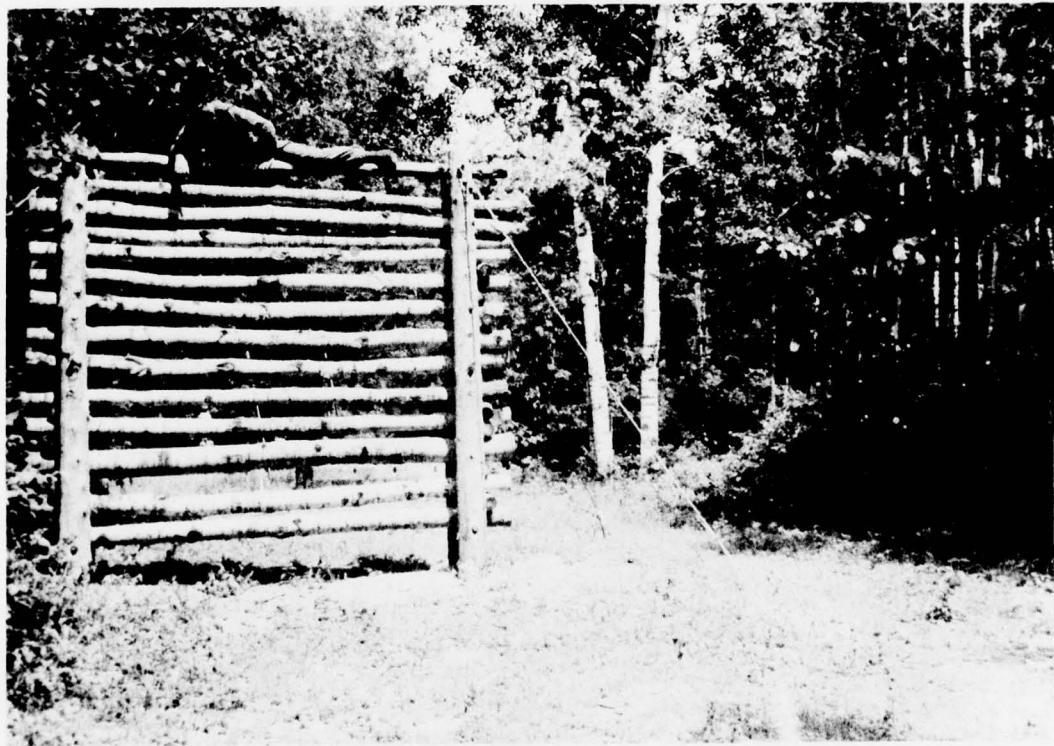


Fig. 39 - Log Wall, 2.7 x 3.1 m high made of 18-cm-diameter logs.  
Subjects climb over.

UNCLASSIFIED

43

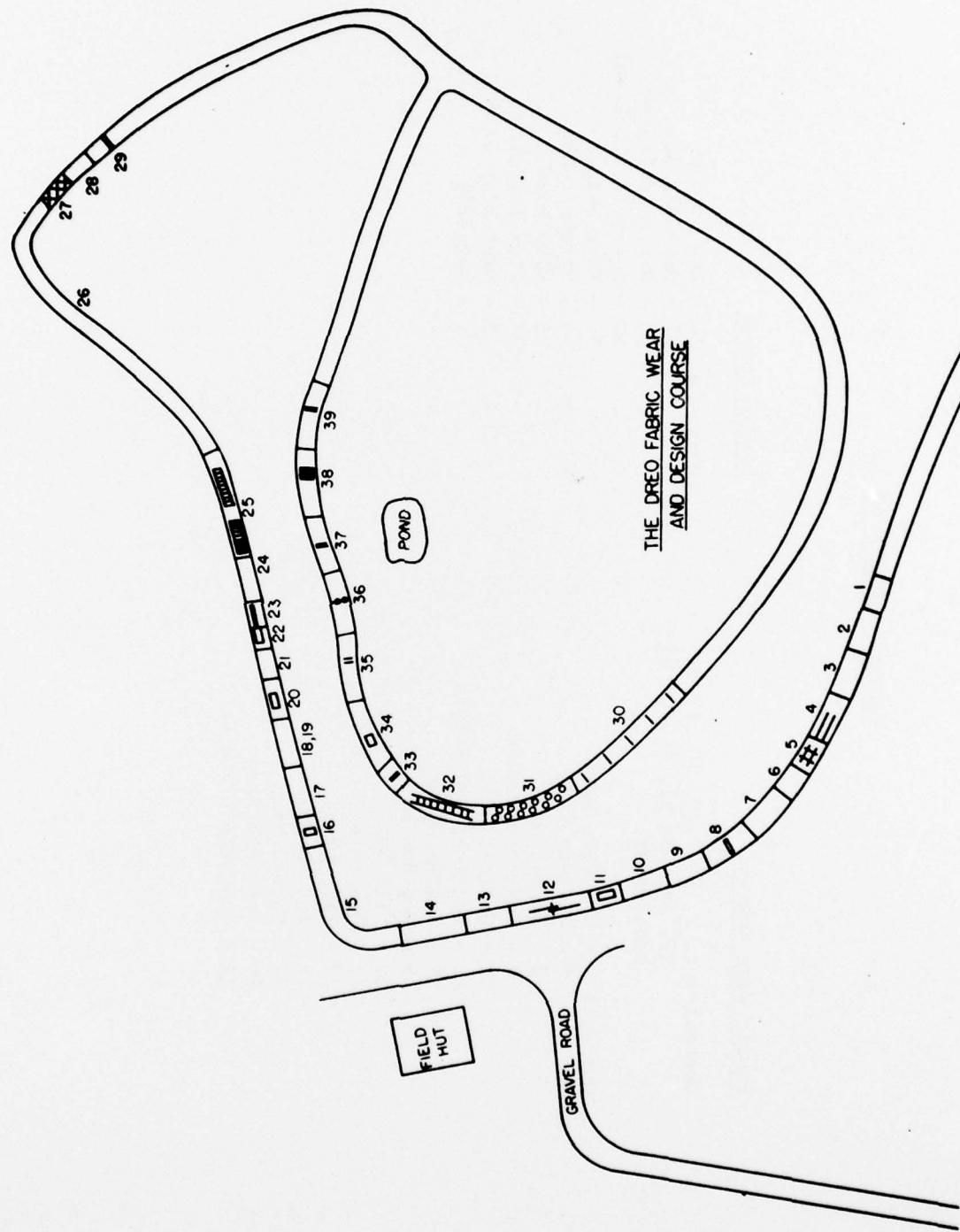


Figure 40. Site Layout: The DREO Fabric Wear and Design Course.

UNCLASSIFIED

UNCLASSIFIED

LEGEND - FIGURE 40

<u>Fabric Wear Course</u>	<u>Design Course</u>
Obstacles 1, 2, 3, 7, 9, 10, 13, 15, 17, 18, 19, 21, 24 and 26 - sand cover.	Obstacle 30 - Low Hurdle 31 - Straddle Run 32 - Overhead Ladder 33 - Concrete Block Wall 34 - Rope Swing 35 - Scramble Net 36 - High Hurdle 37 - Pipe Ladder 38 - High Step Grid 39 - Log Wall
Obstacle 4 - Concrete Wall 5 - Railway Ties 6 - Stone Ramp 8 - Concrete Hurdle 11 - Concrete Pit 12 - Inclined Log Bridge 14 - Gravel Cover 16 - Log Hurdle 20 - Pill Box 22 - Concrete Block Pit 23 - Pipe Crawl 25 - Wooden Ramps 27 - Barbed Wire 28 - Concrete Ramp 29 - Concrete Block Wall	

UNCLASSIFIED

## UNCLASSIFIED

Security Classification

## DOCUMENT CONTROL DATA - R &amp; D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall document is classified)

1. ORIGINATING ACTIVITY Defence Research Establishment Ottawa National Defence Headquarters Ottawa Ontario K1A 0Z4		2a. DOCUMENT SECURITY CLASSIFICATION Unclassified
3. DOCUMENT TITLE The DREO Fabric Wear and Design Course		2b. GROUP
4. DESCRIPTIVE NOTES (Type of report and inclusive dates) Technical Note		
5. AUTHOR(S) (Last name, first name, middle initial) Nolan, R.W. and Dalpé, A.		
6. DOCUMENT DATE February 1977	7a. TOTAL NO. OF PAGES 45	7b. NO. OF REFS 6
8a. PROJECT OR GRANT NO. 79-03-05	9a. ORIGINATOR'S DOCUMENT NUMBER(S) DREO Tech, Note No. 77- 18	
8b. CONTRACT NO.	9b. OTHER DOCUMENT NO.(S) (Any other numbers that may be assigned this document)	
10. DISTRIBUTION STATEMENT Unlimited		
11. SUPPLEMENTARY NOTES	12. SPONSORING ACTIVITY	
13. ABSTRACT  A brief general description of the DREO field facility for evaluating clothing together with a number of photographs which describe the component sections of the testing course in detail is given. Its purpose is to acquaint those who may have a requirement for testing of this nature with the existence and characteristics of the course. (U)		

UNCLASSIFIED

Security Classification

KEY WORDS

Field Testing  
Clothing Evaluation  
Wear Course  
Clothing Design

INSTRUCTIONS

1. ORIGINATING ACTIVITY: Enter the name and address of the organization issuing the document.
- 2a. DOCUMENT SECURITY CLASSIFICATION: Enter the overall security classification of the document including special warning terms whenever applicable.
- 2b. GROUP: Enter security reclassification group number. The three groups are defined in Appendix 'M' of the DRB Security Regulations.
3. DOCUMENT TITLE: Enter the complete document title in all capital letters. Titles in all cases should be unclassified. If a sufficiently descriptive title cannot be selected without classification, show title classification with the usual one-capital-letter abbreviation in parentheses immediately following the title.
4. DESCRIPTIVE NOTES: Enter the category of document, e.g. technical report, technical note or technical letter. If appropriate, enter the type of document, e.g. interim, progress, summary, annual or final. Give the inclusive dates when a specific reporting period is covered.
5. AUTHOR(S): Enter the name(s) of author(s) as shown on or in the document. Enter last name, first name, middle initial. If military, show rank. The name of the principal author is an absolute minimum requirement.
6. DOCUMENT DATE: Enter the date (month, year) of Establishment approval for publication of the document.
- 7a. TOTAL NUMBER OF PAGES: The total page count should follow normal pagination procedures, i.e., enter the number of pages containing information.
- 7b. NUMBER OF REFERENCES: Enter the total number of references cited in the document.
- 8a. PROJECT OR GRANT NUMBER: If appropriate, enter the applicable research and development project or grant number under which the document was written.
- 8b. CONTRACT NUMBER: If appropriate, enter the applicable number under which the document was written.
- 9a. ORIGINATOR'S DOCUMENT NUMBER(S): Enter the official document number by which the document will be identified and controlled by the originating activity. This number must be unique to this document.
- 9b. OTHER DOCUMENT NUMBER(S): If the document has been assigned any other document numbers (either by the originator or by the sponsor), also enter this number(s).
10. DISTRIBUTION STATEMENT: Enter any limitations on further dissemination of the document, other than those imposed by security classification, using standard statements such as:
  - (1) "Qualified requesters may obtain copies of this document from their defence documentation center."
  - (2) "Announcement and dissemination of this document is not authorized without prior approval from originating activity."
11. SUPPLEMENTARY NOTES: Use for additional explanatory notes.
12. SPONSORING ACTIVITY: Enter the name of the departmental project office or laboratory sponsoring the research and development. Include address.
13. ABSTRACT: Enter an abstract giving a brief and factual summary of the document, even though it may also appear elsewhere in the body of the document itself. It is highly desirable that the abstract of classified documents be unclassified. Each paragraph of the abstract shall end with an indication of the security classification of the information in the paragraph (unless the document itself is unclassified) represented as (TS), (S), (C), (R), or (U).

The length of the abstract should be limited to 20 single-spaced standard typewritten lines; 7½ inches long.
14. KEY WORDS: Key words are technically meaningful terms or short phrases that characterize a document and could be helpful in cataloging the document. Key words should be selected so that no security classification is required. Identifiers, such as equipment model designation, trade name, military project code name, geographic location, may be used as key words but will be followed by an indication of technical context.